CLAIMES

1. A plastic optical fiber having a shrinkage stress occurring temperature obtained by thermomechanical analysis of not lower than [(a glass transition temperature of a core) - 35]°C.

2. The plastic optical fiber as claimed in claim 1, wherein the core comprises a homopolymer of methyl methacrylate, or a copolymer comprising a methyl methacrylate unit and another monomer unit.

3. The plastic optical fiber as claimed in claim 1, wherein the core comprises a homopolymer of methyl methacrylate and has a birefringence absolute value of not larger than 2.0×10^{-4}.

4. A plastic optical fiber which has a core comprising a homopolymer of methyl methacrylate and having a birefringence absolute value of not smaller than 1.5×10^{-4} and has a shrinkage stress occurring temperature obtained by thermomechanical analysis of not lower than [(a glass transition temperature of the core) - 20]°C.

5. The plastic optical fiber as claimed in any one of claims 1 to 4, which exhibits a shrinkage ratio of not higher than 2% when heated at 90°C for 65 hours.

6. The plastic optical fiber as claimed in claim 4, which exhibits a shrinkage ratio of not higher than 0.5% when heated at 90°C for 65 hours.

7. A plastic optical fiber cable obtained by forming a coating layer around the plastic optical fiber as claimed in any one of claims 1 to 6.

8. A plastic optical fiber cable that has a protective layer comprising a vinylidene fluoride-tetrafluoroethylene copolymer formed around the plastic optical fiber as claimed in any one of claims 1 to 6 having a core-sheath structure in which the sheath comprises a polymer containing a fluorine-based methacrylate unit or a vinylidene fluoride unit and that has a coating layer comprising Nylon 12 formed on the protective layer.

9. A plugged plastic optical fiber cable obtained by attaching a plug on the tip of the plastic optical fiber cable as claimed in claim 7 or 8.

Sub A7

10. A production method of a plastic optical fiber, comprising the steps of heat-drawing an undrawn plastic optical fiber obtained by melt spinning and annealing the drawn fiber at a circumferential velocity ratio between the front and rear rollers (circumferential velocity of a rear

Sub a2

roller / circumferential velocity of a front roller) of 0.5 to 1.2 under heating conditions which satisfy $4 \leqq y \leqq -1.5x + 330$ and $(Tgc - 5)°C \leqq x \leqq (Tgc + 110)°C$ [Tgc: a glass transition temperature of a core, x: an annealing temperature (°C), and y: an annealing time (seconds)].

11. The production method as claimed in claim 10, wherein a homopolymer of methyl methacrylate, or a copolymer comprising a methyl methacrylate unit and another monomer unit is used as the core.

12. The production method as claimed in claim 10, wherein the core of the plastic optical fiber comprises a homopolymer of methyl methacrylate, the heat drawing is carried out such that the birefringence absolute value of the core becomes 3×10^{-4} or higher, and the annealing is carried out at a circumferential velocity ratio between the front and rear rollers (circumferential velocity of the rear roller / circumferential velocity of the front roller) of not higher than 1 under conditions which satisfy $x \leqq (Tgc + 20)°C$ [Tgc: the glass transition temperature of the core, x: an annealing temperature (°C)].

13. The production method as claimed in claim 10, 11 or 12, which has the step of carrying out annealing under the heating conditions twice or more.

14. A production method of a plastic optical fiber, comprising the step of annealing a plastic optical fiber obtained by the method as claimed in any one of claims 10 to 13 at a temperature not higher than [(a glass transition temperature of a core) + 8]°C.

15. A plastic optical fiber obtained by the method as claimed in any one of claims 10 to 14 and having a shrinkage stress occurring temperature obtained by thermomechanical analysis of not lower than [(a glass transition temperature of a core) - 35]°C.

16. The plastic optical fiber as claimed in claim 15, wherein the core comprises a homopolymer of methyl methacrylate and has a birefringence absolute value of not larger than 2.0×10^{-4}.

17. A plastic optical fiber obtained by the method as claimed in any one of claims 10 to 14, having a core which comprises a homopolymer of methyl methacrylate and has a birefringence absolute value of not smaller than 1.5×10^{-4}, and having a shrinkage stress occurring temperature obtained by thermomechanical analysis of not lower than [(a glass transition temperature of the core) - 20]°C.

18. The plastic optical fiber as claimed in claim 15, 16 or 17, which exhibits a shrinkage ratio of not higher

than 2% when heated at 90°C for 65 hours.

19. A plastic optical fiber cable obtained by forming a coating layer around the plastic optical fiber as claimed in any one of claims 15 to 18.

20. A plugged plastic optical fiber cable obtained by attaching a plug on the tip of the plastic optical fiber cable as claimed in claim 19.

Sub A3

~~21. A production method of a plastic optical fiber, comprising the steps of heat-drawing an undrawn plastic optical fiber obtained by melt spinning and annealing the drawn fiber at a circumferential velocity ratio (circumferential velocity of a rear roller/circumferential velocity of a front roller) between the front and rear rollers of 0.5 to 1.2 under heating conditions which satisfy~~ $4 \leqq y \leqq -1.5x + 330$ ~~and~~ $(Tgc - 5)°C \leqq x \leqq (Tgc + 110)°C$ ~~[Tgc: a glass transition temperature of a core, x: an annealing temperature (°C), and y: annealing time (seconds)] while a tension of~~ 0.35×10^6 ~~to~~ 1.5×10^6 ~~Pa is applied to the fiber.~~

22. A production method of a plastic optical fiber, comprising the step of annealing a plastic optical fiber obtained by melt spinning, at a temperature from (a glass transition temperature of a core - 5)°C to (the glass

transition temperature of the core + 80) °C while a tension of 0.35×10^6 to 1.5×10^6 Pa is applied to the fiber.

23. The production method as claimed in claim 22, which has the step of heat-drawing a plastic optical fiber and carrying out the annealing after heat-drawing the plastic optical fiber.

24. The production method as claimed in claim 21, 22 or 23, wherein a polymer containing a methyl methacrylate unit in an amount of not smaller than 70% by weight is used as the core of a plastic optical fiber.

25. The production method as claimed in claim 22 or 23, wherein a homopolymer of methyl methacrylate is used as the core of a plastic optical fiber and the annealing is carried out at a temperature not higher than (a glass transition temperature of the core + 30) °C such that the core has a birefringence absolute value of not smaller than 1.5×10^{-4} and the plastic optical fiber has a shrinkage stress occurring temperature obtained by thermomechanical analysis of not lower than [(the glass transition temperature of the core) - 20] °C.

26. The production method as claimed in any one of claims 21 to 25, wherein the annealing is carried out by introducing a plastic optical fiber into an annealing zone

substantially vertically to a horizontal plane.

27. The production method as claimed in any one of claims 21 to 25, wherein the annealing is carried out by use of a heating furnace disposed substantially horizontally with a plastic optical fiber to be annealed supported by a heating medium which provides buoyancy to the plastic optical fiber so as to cause the plastic optical fiber to travel within an annealing zone in a non-contact manner.

28. The production method as claimed in any one of claims 21 to 27, wherein the annealing is carried out by alleviation treatment.

29. The production method as claimed in any one of claims 21 to 28, wherein the annealing is hot air annealing.

30. The production method as claimed in any one of claims 21 to 29, wherein the annealing is carried out such that a produced plastic optical fiber exhibits a shrinkage ratio when heated at 90°C for 65 hours of not higher than 0.5%.

31. A production method of a plastic optical fiber cable, comprising the steps of obtaining a plastic optical fiber by the method as claimed in any one of claims 21 to 30, and then forming a coating layer around the obtained optical

fiber.

32. A production method of a plugged plastic optical fiber cable, comprising the steps of obtaining a plastic optical fiber cable by the method as claimed in claim 31, and then attaching a plug on the tip of the obtained optical fiber cable.